

Claims

[c1] What is claimed is:

1.A delay locked loop for use in an integrated circuit device, comprising:

a coarse delay chain in series with a micro-stepped delay chain;

said coarse delay chain including a plurality of coarse delay units configured for selectively providing a coarse delay with respect to an input clock signal, and said micro-stepped delay chain configured for selectively providing a fine delay adjustment with respect to said input clock signal; and

said micro-stepped delay chain further comprising a plurality of parallel signal paths, wherein one or more of said parallel signal paths are capacitively loaded so as to provide said fine delay adjustment.

[c2] 2.The delay locked loop of claim 1, wherein:

a first of said plurality of parallel signal paths comprises a single coarse delay unit;

a second of said plurality of parallel signal paths comprises a pair of coarse delay units; and

the remainder of said plurality of parallel signal paths

each comprising a single coarse delay unit having an intermediate node thereof loaded with a stepped value of capacitance with respect to one another; wherein a signal propagated through any of said remainder of said plurality of parallel signal paths has a delay associated therewith that represents a stepped valued of delay between the delay provided by said single coarse delay unit and the delay provided by said pair of coarse delay units.

- [c3] 3.The delay locked loop of claim 2, wherein said single coarse delay unit comprises a pair of serially connected NAND gates.
- [c4] 4.The delay locked loop of claim 2, wherein:
 - an input signal to said micro-stepped delay chain is coupled to input terminals of each of said parallel signal paths; and
 - a micro-stepping control signal is coupled to said single coarse delay unit and said capacitively loaded single coarse delay units;
 - wherein said micro-stepping control signal is further configured such that only one of said single coarse delay unit and said capacitively loaded single coarse delay units are enabled at a given time.
- [c5] 5.The delay locked loop of claim 4, wherein said micro-

stepped delay chain further comprises an OR gate, said OR gate having each of said plurality of parallel signal paths as inputs thereto.

- [c6] 6.The delay locked loop of claim 5, wherein said pair of coarse delay units is biased in an enabled state such that a maximum delay of a signal propagated through said micro-stepped delay chain is the delay provided by said pair of coarse delay units.
- [c7] 7.The delay locked loop of claim 3, wherein said pair of serially connected NAND gates comprise equalized NAND gates.
- [c8] 8.The delay locked loop of claim 1, wherein said coarse delay chain further comprises:
a plurality of serially connected coarse delay stages, each of said plurality of coarse delay stages configured to selectively provide a discrete number of coarse delay values, wherein the delay value of said discrete number of coarse delay values is successively larger for each successive coarse delay stage.
- [c9] 9.The delay locked loop of claim 8, wherein said coarse delay stages are configured such that discrete number of coarse delay values are implemented by routing an input signal through a specific number of said coarse delay

units included within said coarse delay stages.

- [c10] 10. The delay locked loop of claim 9, wherein said discrete number of coarse delay values are selected through a multiplexing device.
- [c11] 11. The delay locked loop of claim 10, wherein at least a portion of said multiplexing device is configured from one of said coarse delay units.
- [c12] 12. The delay locked loop of claim 9, wherein each of said coarse delay units comprises a pair of serially connected, NAND gates.
- [c13] 13. The delay locked loop of claim 12, wherein said pair of serially connected NAND gates comprise equalized NAND gates.
- [c14] 14. A micro-stepped delay chain for use in a delay locked loop, comprising:
 - a plurality of parallel signal paths coupled to a common input;
 - a first of said plurality of parallel signal paths comprising a single coarse delay unit;
 - a second of said plurality of parallel signal paths comprising a pair of coarse delay units; and
 - the remainder of said plurality of parallel signal paths each comprising a single coarse delay unit having an in-

termediate node thereof loaded with a stepped value of capacitance with respect to one another; wherein a signal propagated through any of said remainder of said plurality of parallel signal paths has a delay associated therewith that represents a stepped valued of delay between the delay provided by said single coarse delay unit and the delay provided by said pair of coarse delay units.

- [c15] 15. The micro-stepped delay chain of claim 14, wherein each of said coarse delay units comprises a pair of serially connected NAND gates.
- [c16] 16. The micro-stepped delay chain of claim 14, wherein: a micro-stepping control signal is coupled to said single coarse delay unit and said capacitively loaded single coarse delay units; wherein said micro-stepping control signal is further configured such that only one of said single coarse delay unit and said capacitively loaded single coarse delay units are enabled at a given time.
- [c17] 17. The micro-stepped delay chain of claim 16, further comprising an OR gate, said OR gate having each of said plurality of parallel signal paths as inputs thereto.
- [c18] 18. The micro-stepped delay chain of claim 17, wherein

said pair of coarse delay units is biased in an enabled state such that a maximum delay of a signal propagated through the micro-stepped delay chain is the delay provided by said pair of coarse delay units.

- [c19] 19. The micro-stepped delay chain of claim 13, wherein said pair of serially connected NAND gates comprise equalized NAND gates.
- [c20] 20. A method for implementing delay locked loop in an integrated circuit device, the method comprising:
 - configuring a coarse delay chain in series with a micro-stepped delay chain;
 - said coarse delay chain including a plurality of coarse delay units configured for selectively providing a coarse delay with respect to an input clock signal, and said micro-stepped delay chain configured for selectively providing a fine delay adjustment with respect to said input clock signal; and
 - configuring a plurality of parallel signal paths within said micro-stepped delay chain, wherein one or more of said parallel signal paths are capacitively loaded so as to provide said fine delay adjustment.